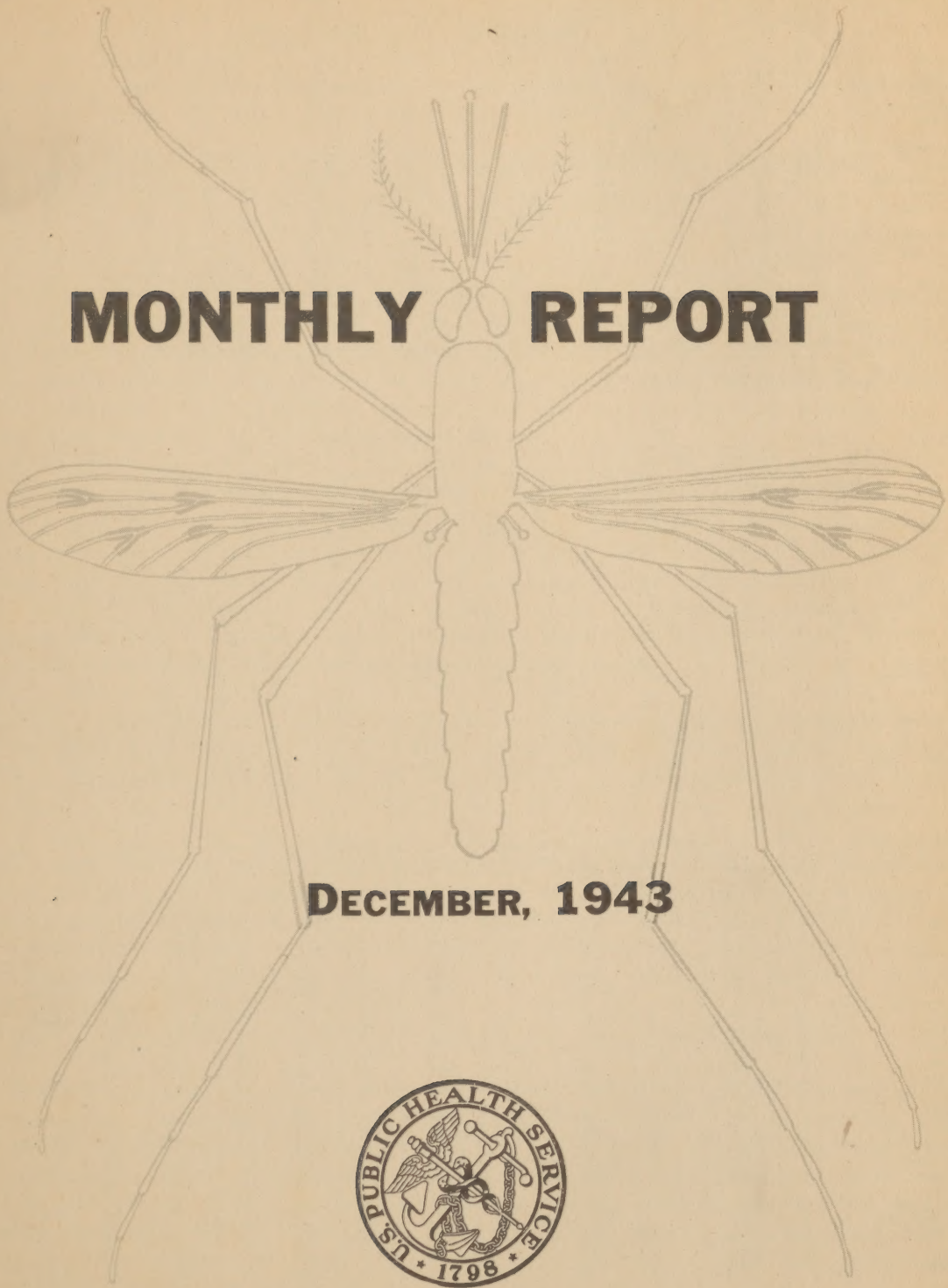
MALARIA CONTROL IN WAR AREAS



MONTHLY REPORT

DECEMBER, 1943

FEDERAL SECURITY AGENCY
U. S. PUBLIC HEALTH SERVICE
ATLANTA, GEORGIA

TABLE I — MCWA LARVICIDE AND MINOR DRAINAGE PROJECTS — DECEMBER 1 - 31, 1943

STATE	Areas in Operation	War Establishments Protected	LARVICIDAL WORK			OTHER WORK					Total Man Hours	Total Men Employed
			Larvicide Used		Surfaces Treated	Ditching		Cleaning	Clearing	Water Surf. Eliminated		
			Oil Gals.	Paris Green Lbs.	Acres	Cu.Yds.	Lin.Ft.	Lin.Ft.	Acres	Acres		
Alabama	3	73	---	---	---	313	2,480	21,820	---	0.9	2,367	12
Arkansas	10	70	---	---	---	2,368	16,176	36,560	4.9	24.8	10,327	66
California	4	29	---	---	---	*	5,600	78,594	2.0	---	4,144	21
D. C.	1	25	---	---	---	389	260	5,365	0.4	---	1,961	10
Florida	15	141	1,135	---	29.2	8,056	43,577	142,134	10.7	50.7	31,869	168
Georgia	12	101	---	26	21.7	2,740	13,217	54,026	22.7	15.7	22,554	118
Illinois	1	56	---	---	---	---	---	---	---	---	482	2
Kentucky	3	45	---	---	---	10	138	---	---	---	2,096	12
Louisiana	8	68	6,987	804	893.3	8,838	74,341	139,358	84.4	27.5	53,577	337
Maryland	1	29	---	---	---	237	1,600	8,300	3.7	3.3	3,340	18
Mississippi	5	55	---	---	---	2,130	12,613	225,683	19.3	3.7	8,320	52
Missouri	3	34	---	---	---	84	398	763	1.0	1.1	2,180	10
North Carolina	9	72	---	---	---	1,243	14,421	290,615	18.6	41.6	14,777	92
Oklahoma	1	38	---	---	---	---	---	---	---	---	1,664	9
Puerto Rico	5	19	320	7,673	10,517.4	662**	528,118	553,118	39.8	1.9	64,059	446
South Carolina	6	111	2,067	---	140.0	1,588	7,373	114,461	---	3.0	7,826	48
Tennessee	2	69	---	---	---	844	4,950	4,134	20.6	5.3	6,884	40
Texas	14	164	3,691	64	236.7	2,362	33,914	202,299	74.7	36.5	30,734	181
Virginia	4	99	---	---	---	4,649	49,323	6,837	27.1	0.1	18,443	135
Total	107	1,298	14,200	8,567	11,838.3	36,513	809,312	1,884,067	329.9	216.1	287,604	1,777
November Total	122	1,137	60,547	12,097	16,881.9	44,522	550,307	1,789,478	462.2	234.8	371,857	2,056

* Figures not available.
** Complete figures not available.

TABLE II — MCWA MAJOR DRAINAGE PROJECTS — DECEMBER 1 - 31, 1943

STATE	No. of Projects	Clearing Brushing Acres	Channel or Ditch Cleaning Lin.Ft.	New Ditching				Fill. Cu.Yds.	Ditch Lining Placed		Underground Drains Lin.Ft.	Water Surf. Eliminated Acres	Total Man Hours
				Hand	Lin.Ft. Mach.	Dynamite	Total Cu.Yds.		Sq.Ft.	Lin.Ft.			
Alabama	2	2.0	---	600	---	9,150	6,200	---	---	---	---	50.0	3,629
Arkansas	2	0.3	3,250	3,611	695	4,725	9,613	123	---	---	1,860	1.0	3,830
Florida	1	---	1,300	---	---	---	---	---	---	---	---	---	2,728
Indiana	1	0.4	---	503	---	---	342	---	---	---	---	---	612
Kentucky	2	1.0	---	395	---	---	47	---	---	---	---	---	436
Mississippi	1	---	---	115	---	---	8	27	1,142	680	---	0.2	1,616
Missouri	1	---	---	---	---	---	---	---	---	---	---	---	1,268
North Carolina	8	7.6	18,531	19,296	575	10,988	10,637	1,616	---	---	221	140.2	16,489
Puerto Rico	4	1.6	550	2,270	---	150	4,518	200	18	---	---	---	35,668
South Carolina	17	12.0	48,459	20,765	1,620	2,505	8,371	859	---	---	---	48.8	33,039
Tennessee	2	---	---	468	---	---	298	107	450	250	763	---	1,724
Texas	7	8.2	2,000	9,610	---	---	3,473	339	---	---	---	21.0	8,392
Total	48	33.1	74,090	57,633	2,890	27,518	43,507	3,271	1,610	930	2,844	261.2	109,431
November Total	37	44.4	30,270	62,090	6,523	20,049	71,393	2,613	6,817	2,295	279	222.7	103,994

TABLE III — MCWA PERSONNEL ON DUTY ON DECEMBER 31, 1943 AND TOTAL PAYROLL FOR MONTH OF DECEMBER — DECEMBER 1 - 31, 1943

STATE	Commissioned		Prof. & Sci.		Sub-Prof. (1)		C. A. F.		Custodial		Total		Percent of Total	
	No.	Pay	No.	Pay	No.	Pay	No.	Pay	No.	Pay	No.	Pay	No.	Pay
Alabama	5	1,389	1	264	2	189	3	531	35	4,663	46	7,036	1.5	1.7
Arkansas	6	1,727	3	952	22	4,170	4	738	87	9,822	122	17,359	3.9	4.3
California	2	570	---	---	5	1,044	2	458	21	3,187	30	5,259	1.0	1.3
D. C.	1	333	1	319	3	583	2	367	7	1,061	14	2,663	0.5	0.7
Florida	5	1,504	6	1,812	17	3,354	5	946	187	23,466	220	31,082	7.1	7.8
Georgia	4	1,199	4	1,038	33	6,327	5	728	92	11,795	138	21,087	4.4	5.3
Illinois	4	1,020	4	1,004	1	233	5	842	2	323	16	3,422	0.5	0.8
Indiana	1	285	---	---	---	---	---	---	7	920	8	1,205	0.3	0.3
Kentucky	2	570	2	626	4	852	1	198	11	1,703	20	3,954	0.6	1.0
Louisiana	11	2,933	7	2,117	43	8,339	5	915	300	38,415	366	52,719	11.7	13.2
Maryland	1	248	---	---	4	558	2	410	15	2,147	22	3,363	0.7	0.8
Mississippi	4	1,189	2	264	10	2,220	3	410	51	6,267	70	10,350	2.3	2.6
Missouri	2	570	1	264	13	2,433	1	152	12	1,758	29	5,167	0.9	1.3
North Carolina	6	1,719	7	2,321	10	1,931	3	574	186	23,566	212	30,111	6.8	7.5
Oklahoma	2	581	3	970	6	1,267	1	146	4	996	16	3,960	0.5	1.0
Puerto Rico	7	2,438	---	---	12	2,160	6	1,016	719	31,338	744	36,952	23.9	9.3
South Carolina	4	1,189	5	1,429	32	5,057	5	971	247	30,951	293	39,597	9.4	9.9
Tennessee	4	1,140	2	475	6	1,430	2	216	48	6,177	62	9,438	2.0	2.4
Texas	9	2,511	5	1,534	27	5,880	4	738	212	27,256	257	37,919	8.3	9.5
Virginia	3	851	2	688	11	2,228	2	428	129	15,640	147	19,835	4.7	5.0
AEDES AEGYPTI														
Florida	1	285	---	---	24	4,347	1	164	2	341	28	5,137	0.9	1.3
Georgia	3	904	---	---	8	1,582	2	208	1	52	14	2,746	0.5	0.7
Louisiana	1	285	1	132	17	3,160	1	107	---	---	20	3,684	0.6	0.9
South Carolina	2	533	---	---	11	1,819	1	146	2	250	16	2,748	0.5	0.7
Texas	5	1,425	2	393	15	2,373	2	194	11	2,282	35	6,667	1.1	1.7
H. Q. & Dist. (2)	49	15,468	9	2,284	14	2,542	85	14,376	11	1,245	168	35,915	5.4	9.0
Total	144	42,866	67	18,886	350	66,018	153	25,979	2,399	245,626	3,113	399,375	100.0	100.0
Percent of Total	4.6	10.8	2.2	4.7	11.2	16.5	4.9	6.5	77.1	61.5	100.0	100.0		

(1) Includes Entomological Inspectors
(2) Includes Headquarters and District Offices, malaria survey, special investigations, and employees temporarily attached to Headquarters pending assignment to states.

MALARIA CONTROL IN WAR AREAS DEC. 1943

Monthly Report

THE ENTOMOLOGICAL PHASES OF MALARIA CONTROL PROGRAMS*

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Literature abounds with discussions of the possibility and practicability of the control or eradication of malaria by medication of the human host. However, the therapeutic, immunological or other methods to accomplish this end have yet to be found and therefore the time honored attack, that of the control of the insect vector, must still be considered the most effective means for reducing the human malaria infection rate.

Insect control measures, to be effective and economical, must be based on the biology and habits of the particular species involved. The determination of the dangerous species and the study of its habits are entomological functions whether performed by the entomologist or by those of other disciplines. This is not a discussion of the place of the entomologist on malaria control programs but rather of the use of entomological findings and methods on a task which essentially lies within the field of economic entomology.

The first important contributions to mosquito biology in this country were made by Dr. L. O. Howard (1, 2), who in 1900 published a bulletin entitled "Notes on the Mosquitoes of the United States" and later in 1901 a more comprehensive volume entitled "Mosquitoes: How they live: How they carry disease: How they are classified: How they may be destroyed". These studies, which were prompted by the then recent incrimination of mosquitoes in the transmission of yellow fever and malaria, gave only an inkling of the variety of mosquito species, the diversity of their habits and the complexities of their control. They did, however, make information on the differences between anopheline and culicine mosquitoes generally available. In spite of this, mosquito control programs undertaken for malaria control in the United States in those early days seem to have been prosecuted indiscriminately against all types of mosquitoes.

The first control work directed solely against anopheline mosquitoes for malaria control appears to have been that done by Herms (3) at Penryn, California in 1910. This marked the beginning of the use of anti-anopheline rather than general anti-mosquito measures in malaria control in the United States. In 1912, Carter and Von Ezdorf of the U.S. Public Health Service initiated studies and practical demonstrations of malaria control in the south by which anti-anopheline measures were advocated and this constructive work laid the ground-work for the extensive projects which have since been prosecuted.

* Presented at the meeting of the National Malaria Society, November 17, 1943.

It was about this same time (1910) that Darling (4), working in Panama, found that all species of anophelines are not alike in their ability to transmit malaria and that *Anopheles albimanus* was the chief malaria transmitter of that region. From this important discovery was evolved the principle of "*Anopheles*-species control of malaria" or "species-sanitation" as it is sometimes called. By the application of this principle, as was done in the Canal Zone with marked success, malaria mosquito control can be limited to the vector or vectors and results obtained with a minimum of effort and expenditure, thus putting the work on an economical basis. However, in order to do this selective work it is imperative that careful entomological studies precede inauguration of the work and that supervision be maintained.

In spite of the successful experience with species sanitation in Panama, this method of malaria control has been slow of adoption in the United States. This seems to have been attributable not so much to a lack of information on the species of anophelines involved in malaria transmission and their habits as to a desire on the part of those charged with the work to cater to popular demand for general mosquito control. Measures directed against all anophelines or against all mosquitoes, if successful, will produce results in malaria control and this is logically the reason for a lack of interest in refinements of procedure. General mosquito eradication programs are of great public benefit and are desirable where money is available for this expensive work. However, it is quite probable that malaria control, which involves much simpler and less expensive operations, has been greatly retarded because of these attempts at all-inclusive mosquito control. It was not until 1937, when the boards of health of a number of southern states employed entomologists, that much attention was given to species sanitation in malaria control work in this country. Provision for the employment of these men and also for their training under specialists of the U.S. Bureau of Entomology and Plant Quarantine, the Rockefeller Foundation and the Public Health Service was made possible by expenditures of funds alloted to the states by the U.S. Public Health Service. A survey of their work made by the writer in 1939 (5) indicated that about 50% of their time was being spent in field malaria mosquito surveys, 17% in research on mosquitoes and the remaining 33% included supervision of field control operations and educational work on malaria and mosquito control. The employment of these entomologists marked the beginning of a period of progressively increasing application of the accumulated knowledge of anopheline bionomics to malaria control work.

With the advent of the present war, cognizance was taken at once of the need for entomological work in malaria control by both military and civilian health authorities. The number of entomologists who had even a smattering of knowledge of mosquito biology and control was, of course, inadequate to meet the demand for those services. However, for those who have had broad entomological training, the transition from work on one group of insects to another is not difficult and it is certain that those who have lately taken up work in this field have contributed greatly to the efficiency of malaria control.

The entomological phases of a malaria control program are those which have to do with the insect vector. Presupposing that a locality is known to be malarious or is epidemiologically suspected, it is the function of the entomologist first to make a thorough entomological survey of the area. This includes determination of the local anopheline fauna and the relative abundance of the various species which is done by collecting adults from a good series of diurnal shelters, by the use of bait and light traps and by records of biting. Records

should be made of the location at which these data are collected, of the types of shelters and of traps used, and the length of time over which biting observations are made. The numbers of each species of *Anopheles* taken in each case should be carefully recorded so that with subsequent accumulation of data from these same places reliable evaluations of the effect of the control work can be made. Density observations both within the control area and in similar adjacent areas which will not be affected by control work are necessary so that measurements of progress can be made on the basis of normal seasonal abundance of the vectors.

In case the vector is not known, the next step is to determine which of the local species are harboring malaria plasmodia. This technical work, which involves careful handling and dissection of mosquitoes is logically a job for the parasitologist, and if one is available the work of the entomologist in this connection may consist only of obtaining the necessary specimens and field data. With the results of this study at hand, that is, the naming of the vector species, it is possible to proceed with the formulation of plans for the control of these individual species, or in other words, to practice species-sanitation. This requires, first of all, the finding of their breeding places. To do this, the best available map should be secured and a reconnaisance of the area made to locate as far as possible all waters within a radius of the population to be protected, the length of which will depend on the flight range of the particular vector concerned. Anophelines being as a rule weak fliers, this distance can be approximated at one mile for preliminary work. The water areas should be spotted on the map and each searched for the occurrence of larvae. Mapping and searching for larvae may of course be done concurrently. Specific identification of the specimens found must be made and can be done either by rearing specimens and determination of adults or by larval identification. In practice both methods should be used to obviate chances for error. Having proceeded this far, the entomologist is in a position to name the vector or vectors involved, their abundance and their breeding places at the time of the survey. With this information at hand the problem of control can be approached from the engineering aspect in a logical manner.

As control work progresses, it is necessary that careful routine observations be made to determine the effectiveness of the work in reducing local vector densities. If these are not lowered to a satisfactory level, the reason must be found. It may lie in ineffective larvicidal work, undiscovered breeding places, formerly non-breeding areas coming into production, or unusual flights from extensive breeding areas outside the control zone. In any case the finding of the trouble will indicate the necessary remedial measures.

Anopheline mosquitoes, in common with other insects, vary greatly in their biting, associational, breeding and flight habits, not only between species, but within the individual species in different latitudes and at different seasons. Biting, associational and longevity habits, together with the customs of the human population within its range are all-important in determining the probability that an individual species will transmit malaria; for so far as is known at least, all species of anophelines are susceptible of infection by malaria plasmodia, although some are more or less refractory to certain parasite species. Breeding and flight habits are all-important in determining the control measures for a given species. The determination of all these factors in any area and their application to control practices is the only logical approach to intelligent

anopheline mosquito control. If the vector is eradicated or reduced to inconsequential numbers, we know that malaria will be controlled. Reports on miles of ditches dug, gallons or pounds of larvicide used or money spent give an index only to the size of the job done. The contribution of this work to malaria control must be measured by the actual reduction in the vector species accomplished.

At the meeting of the National Malaria Society last year a paper was presented which detailed the entomological procedures used for guiding anopheline control work on the Malaria Control in War Areas program being prosecuted by the U.S. Public Health Service in cooperation with State Boards of Health (6). The following of those procedures has resulted in a close integration of the work of the engineer and entomologist in planning and instituting control measures and in evaluating their results. This has placed control work on a sound basis. Whether on a large project or a small one, the criterion of satisfactory work is the reduction and maintenance at low levels of malaria vector populations. Success or failure of a malaria mosquito control project is determined by the answer a supervisor can give to our universal query "What are your density counts"?, or more familiarly in the south at least, "What are your 'quad' counts"?

Literature Cited

1. Howard, L.O.

   1900. Notes on the Mosquitoes of the United States, U.S. Department of Agriculture, Div. Entom., Bull. 25, N.S.

2. Howard, L.O.

   1901. Mosquitoes. McClure, Phillips & Co., New York.

3. Herms, W.B.

   1913. Malaria - Cause and Control. McMillan Co., New York.

4. Darling, S.T.

   1910. Studies in Relation to Malaria. Rept. Isthmian Canal Commission, Government Printing Office, Washington.

5. Bradley, G.H., Bellamy, R.E., and Bracken, T.T., Jr.

   1940. The Work of State Board of Health Entomologists on Malaria Control, S. Med. Journal, 33, 8, pp 892 - 894.

6. Bradley, G.H. and Hanson, H.G.

   Malaria Control in War Areas. Entomological Services in the Regulation of the Larvicide Program. In press.

BOOK REVIEW

"THE ORGANIZATION OF PERMANENT NATION-WIDE ANTI-AEDES AEGYPTI MEASURES IN BRAZIL" by Fred L. Soper, D. Bruce Wilson, Servulo Lima, and Waldemar Sa Antunes - The Rockefeller Foundation, New York, 1943.

This 137 page publication describes in detail both the administrative and operational techniques utilized by the Yellow Fever Service maintained jointly by the Brazilian Government and the Rockefeller Foundation for the period 1929 - 1940. It is essentially an adaptation of the Administrative Manual which is the basis of operations for the Yellow Fever Service whose objective is the eradication of *Aedes aegypti* from Brazil. It contains no cost data.

The introductory pages present important summaries of Brazilian and other experience in yellow fever control as follows:

(1) The period 1926 - 1940 demonstrated the impossibility of eradicating yellow fever but also developed great advances in basic knowledge including the discovery of animal susceptibility; the rediscovery of the virus origin; the demonstration that mosquitoes other than *Aedes aegypti* can and do transmit the virus; the development of the protection test for determining immunity; the organization of viscerotomy for diagnosis of unsuspected fatal cases; the proof that unrecognized yellow fever has been widespread in large silent endemic areas of South America and Africa; the demonstration that the disease exists in many countries of South America as one of jungle animals, independent of the distribution of *Aedes aegypti* and of man; and the modification of the yellow fever virus in such a way as to make mass vaccination practicable.

(2) In many areas of South America *aegypti* - transmitted yellow fever outbreaks have probably resulted from transfer of jungle yellow fever virus to towns and cities. In northeast Brazil, however, where jungle yellow fever does not exist, permanent *aegypti* - transmitted endemicity formerly existed evidently because of rural distribution of *Aedes aegypti* which was able to maintain yellow fever in rural areas for long periods after its elimination from cities.

(3) Brazilian experience has demonstrated that breeding cannot be controlled economically simply by reducing the intensity of breeding in metropolitan areas, but that species eradication, and further, eradication in an entire region (including rural as well as urban areas) presents actually the lowest annual cost.

(4) The permanent campaign against *Aedes aegypti* (to secure and retain eradication) falls into three distinct divisions: an initial clean-up campaign to eliminate the easily accessible foci, followed by the finding and elimination of hidden inaccessible breeding places, and finally, the permanent maintenance of a relatively inexpensive "sentinel service" to discover and eliminate reinfestations.

(5) Detailed records and maps pay for themselves many times over if studied and used to orient an ever-shifting strategy of campaign against the species; in fact, the expenditure of 25 to 30% of the labor budget for checking the work done has proved to be sound practice.

The remainder and bulk of this book describes the Brazilian anti-*aegypti* technique in elaborate detail, with numerous forms and illustrations, under subheadings as follows: general administration, routine organization of work in urban centers, complimentary services in rural areas, special services, organization of anti-*aegypti* measures in the interior, statistics, and legal enforcement. These details will be of considerable interest to those engaged in any phase of domestic mosquito control.

- Harvey F. Ludwig, Assistant Engineer

* * *

QUESTIONS AND ANSWERS

Referring to the article "MISSOURI SOLVES UNUSUAL CONTROL PROBLEM" appearing in the November 1943 Monthly Report, W. Stewart Kuttler, Assistant Engineer (R) asks in what position the wire fences were placed in relation to the center line of the stream. He suggests that if the fences were placed diagonally across the stream, possibly at an angle of 45°, the resultant force parallel to the fence would put the floating vegetation next to the bank where it could be more easily removed.

In reply, Nelson H. Rector, Sanitary Engineer (R) states that the fences were placed across the stream at right angles to the current. Very heavy loads of material collect behind the fences, and if they were set at an angle to the center line of the ditch the flow of the canal would tend to pile up the Ceratophyllum faster and necessitate either cleaning the ditch at more frequent intervals or create sufficient pressure to force the material through the fence. He believes that placing the fence at a 45° angle would work well if the amount of material coming down the canal were small.

(The Monthly Report will welcome questions about articles appearing in the report, or problems of control encountered in the field.)

* * *

ORIENTATION COURSE IN HEALTH EDUCATION HELD

The Training and Education Division recently sponsored an orientation course on community health education at the Atlanta office under the direction of Dr. Mayhew Derryberry, Chief, Field Activities in Health Education, and Mr. S.S. Lifson, Associate Health Education Consultant. The course was designed to acquaint the workers with accepted methods and practices of community education, and to assist them in making plans for the coming season. Those attending included MCWA personnel assigned to malaria education, and representatives from the *Aedes aegypti* program.

Among the subjects discussed were the objectives of community education, and methods of approaching the problem through organized groups, meetings, radio and newspapers, and individual contacts.

In addition to the discussions on educational techniques, refresher lectures and demonstrations on malaria and its control were given by members of the Training and Education Division.

DRAINAGE PROJECTS SHOW PROGRESS

During the month of December most malaria control activity centered around drainage operations. Thirteen major drainage projects were approved at a total cost of $66,801. Good progress was being made on both major and minor drainage, and judging by reports from the field almost all Class A and B drainage will be near completion before the actual mosquito breeding season begins.

Draglines were in use in South Carolina, Arkansas, and Texas, with the one in Texas being supplied by the local sponsor, and a contract has been let for a dragline project in Georgia. Concrete inverts were being constructed in four states in areas where it was felt this type work was justified.

According to present plans an area of approximately 500 acres which lies immediately south of Dale Mabry Field in Tallahassee, Florida will be completely drained before the mosquito breeding season begins in the spring. The county in which the project is located furnished a dragline for the construction of a main outlet ditch through a sand ridge, and also furnished the same machine for the construction of a short dike which was absolutely essential to the operation of the project.

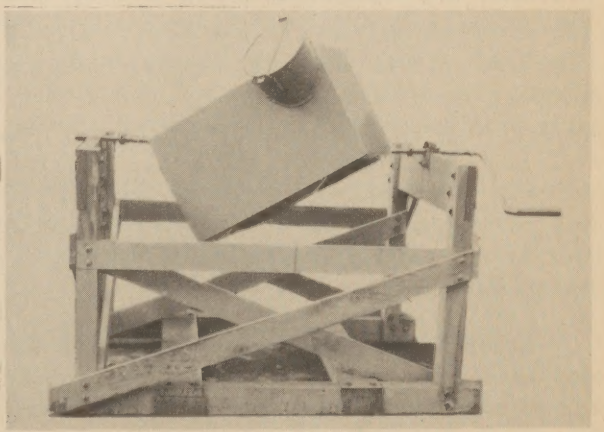
* * *

IMPROVED DUST MIXER DEVELOPED

The MCWA headquarters office has recently developed a 34 gallon rectangular dust mixer which is expected to prove very useful to field projects. It is planned to make a limited number of these mixers available for use on programs doing a large amount of Paris Green dusting.

Comprised of two parts, a wood frame or stand, and a steel mixing chamber, the mixer can be knocked down for storage or transit in ten minutes, and is easily reassembled. The frame is sturdily built to withstand shocks or abrasions. No nails are used in construction; the entire frame is bolted together.

The mixing chamber is a rectangular steel box mounted on an axis rod which acts as a crank. It is secured to the stand by two bearings which are located at the front and rear of the stand. The front bearing is a split bearing, and the top part is removed to set the chamber in place. There are two collars, 1 1/2 by 1 3/4 inches, with set screws which steady the mixer against the frame. The cranking arm has a sleeve to prevent blistering the operator's hand. The most efficient mixing is obtained by rotating the box slowly.



A circular loading arrangement was designed with an eight inch steel collar having a removable lid. The lid, when rotated, interlocks with two arms which are fastened to the collar. The collar arrangement facilitates the removal of all dust from the mixer when unloading.

AEDES AEGYPTI REPORT

Initial plans were made during December for an *Aedes aegypti* educational program during the coming breeding season, and preliminary arrangements were made for a widespread distribution of premise bulletins in important cities where control projects are not being operated. The program will be operated jointly by the *Aedes aegypti* Section and the Division of Training and Education, and will include an estimated 15 cities in about eight southern states. The bulletins will be distributed principally by OCD Block Leader groups in the selected cities. They will endeavor to enlist the support of housewives in keeping their own homes and yards free of water containing receptacles which are potential breeding places.

* The 16mm. film, "*Aedes aegypti* Control", photographed at Key West, and designed for training new inspectors, has been completed by the Division of Training and Education, and has been distributed to the projects. Another 16mm. technicolor lay film (designed for lectures) and two 35mm. movie trailers should be completed within a few weeks.

* The dengue control program begun at Honolulu, Hawaii in August 1943 by P.A. Engineer (R) W. E. Gilbertson continues in operation. As of December 31, a total of 158 workers were employed on the program, of which 86 were furnished by the U. S. Army, 20 by the Honolulu Chamber of Commerce, and 52 by the Public Health Service. During November and December the number of dengue cases decreased sharply.

* Special research work was inaugurated in Texas by the assignment of professional entomologists to Houston and to the Rio Grande Valley to study effects of the winter weather on the *aegypti* life cycle. Further knowledge of this subject will undoubtedly permit more intelligent planning of year around control activities in geographical areas where winter frosts occur.

* During the winter season operations on most of the projects will be changed from routine premise inspections to such activities as : (1) eliminating important permanent foci, as by screening, capping, or destroying cisterns; (2) eliminating hold-over winter breeding places, such as water plants inside homes; (3) arranging regular larviciding or correction schedules for important non-residential areas such as warehouses, wharfs, junk yards, and cemeteries not adequately provided for during the summer; and (4) tabulating, analyzing, and mapping the mass of data recorded during the summer.

* By the end of December *aegypti* breeding indexes at all projects excepting Key West and the lower Rio Grande Valley decreased to values of from one to three per cent. Indexes averaged between six and seven per cent at Key West and the lower Rio Grande Valley.

* A comprehensive mapping program has been planned for the anti-*aegypti* projects and several of the maps drawn up by the Headquarters Drafting Section. Linen tracings will be prepared for each project, both for the project area, and for a book of detailed maps. These will show inspection zones and other general data, and specific data such as locations of permanent breeding foci, places of public congregation and relative breeding densities within the various zones. The maps are designed principally for emergency use in the event of an epidemic but should also be of value in facilitating routine operations.

"ADULT STATIONS"

Changes in Headquarters

Griffith E. Quinby, Assistant Surgeon (R), Chicago, Ill.; Edward P. Mullany, Passed Assistant Engineer (R), Greenville, Texas; William J. Buchanan, Assistant Engineer (R), Indianapolis, Indiana; Charles J. Rohde, Assistant Sanitarian (R), McAllen, Texas.

New Commissions

Eli Abbott, Jr., Sanitarian (R); Woodrow W. Farrar, Assistant Sanitarian (R); George R. Hayes, Jr., Assistant Sanitarian (R).

* * *

Table IV

MCWA Encumbrances and Liquidations by Major Items
For the Month of December 1943

	Continental U.S.	Percentage of Total	Puerto Rico	Percentage of Total
.01 Personal Services	$362,422.97	86.29	36,952.19	92.82
.01 Personal Services (Supplemental Payrolls*)	19,341.87	4.60	---------	-----
.02 Travel	5,480.66	1.30	400.00	1.01
.03 Transportation	7,367.76	1.76	---------	-----
.04 Communication Services	891.23	0.21	25.00	0.06
.05 Rents and Utilities	1,804.77	0.43	---------	-----
.06 Printing and Binding	--------	-----	---------	-----
.07 Other Contractual Services	4,155.96	0.99	6.35	0.02
.08 Supplies and Materials	14,133.93	3.37	2,406.15	6.04
.09 Equipment	4,389.31	1.05	17.00	0.05
Total	419,988.46	100.00	39,806.69	100.00
Expenses other than Personal Services	38,223.62	9.11	2,854.50	7.18

* Includes supplemental payrolls for July, August, September, October, and November


AVERAGE ANNUAL
MALARIA MORTALITY RATES
BY COUNTIES
IN 16 SOUTHEASTERN STATES
1935 – 1939
LEGEND
AVERAGE ANNUAL DEATHS
PER 100,000
0
0.1 – 9
10 – 19
OVER 20
Scale of Miles
0
50
100
150